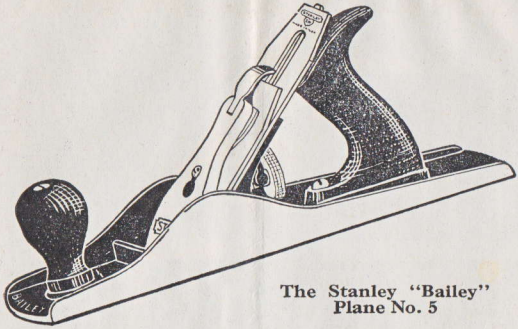
STANLEY
Rafter and Framing
SQUARES

For over 70 years



The Stanley "Bailey" Plane No. 5

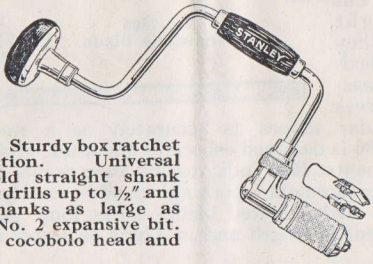
No tool is better known to woodworkers than the Stanley "Bailey" Plane. For over 70 years it has been building friendship with tool users. Continual improvements in design, materials and workmanship have kept STANLEY PLANES abreast of the times. The result is that 9 out of every 10 planes in use today are STANLEY PLANES —a real tribute from a group of craftsmen who know what they want.

When confronted with a planing job—unusual or regular—there is a STANLEY PLANE that will do it. There are 130 different planes illustrated in Stanley No. 34 Catalog.

Woodworkers Prefer

STANLEY BIT BRACES

1843 STANLEY 1943



No. 923. Sturdy box ratchet construction. Universal jaws hold straight shank bits and drills up to ½" and taper shanks as large as Clark's No. 2 expansive bit. Selected cocobolo head and handle.

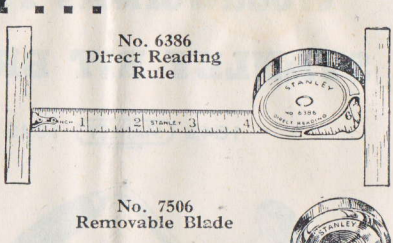
When an exacting group of craftsmen prefer a particular make of tool you can believe there is a good reason or reasons back of their choice. There are many reasons why you see so many Stanley Braces in carpenters' tool kits. Here are a few of them:—

1. Strong, rugged construction.
2. Ease of operation.
3. Lasting bright finish.
4. Braces for every purpose.
5. Years of satisfactory use by thousands of craftsmen.

Stanley Bit Braces are made in seventeen styles in a number of sizes. Catalog No. 34 shows the complete line.

HANDY . . .

Stanley "Pull-Push" Steel Rule Blades are rigid for measuring straight distances, but with slight pressure they become flexible for measuring curves and angular shapes as accurately as a steel tape.



No. **6386** is designed especially for inside and outside measurements. Red indicator on case points to exact inside measurement—nothing to add—no chance for mistakes. Nickel plated blade, 6 feet long, graduated in 16ths entire length and in 32nds on upper edge for 6 inches.

No. **7506** has removable blade that can be used free for end to end measurements, and for direct inside measurements. Nickel plated case totally closed to date. Blade, nickel plated, is 6 feet long, graduated entire length in 16ths, and in 32nds on upper edge for 6 inches.

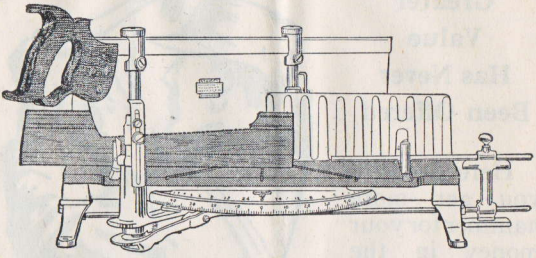
THE Rules You've Always Carried

NOW—graduated on all edges in inches and sixteenths for convenience and accuracy. Large Gothic Figures—much easier to read. Stainless Joints—rustproof—longest wearing joints ever offered. Finer appearance—new Stanley lacquer gives a more durable and beautiful appearance.

Other features are: selected hardwood sticks sealed against moisture; concealed joint rules have strike plates on each stick; strong spring joints hold rule rigid and prevent "jack-knifing"; direction arrows that tell which end of rule to start measuring from.

If it's a "Zig-Zag" Rule it's a Stanley Rule

STANLEY
MITER BOX No. 2358



Accurate *Simple in Design*

Easy to Use *Strong and Sturdy*

Minimum Number of Parts

Best Miter Box made for wood-working. Swivel and uprights are cast in one piece from malleable iron, making them practically unbreakable. First quality Back Saw, 28″ x 5″, furnished with No. 2358 Miter Box. Quadrant is graduated in degrees and is numbered for sawing 3, 4, 5, 6, 8, 12 and 24 sided figures.

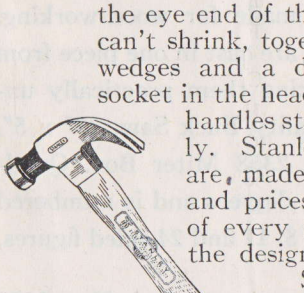
We unhesitatingly recommend No. 2358 Miter Box as a quality tool for quality work. Your hardware dealer has this Miter Box and other Stanley Miter Boxes of different design awaiting your inspection.

STANLEY NAIL HAMMERS

Greater Value Has Never Been Offered

Here is why you get more hammer for your money in the Stanley line:

1. Heads are super heat-treated—a series of heat treatments after forging and individual tempering on face and claws makes a harder, tougher head.
2. "Evertite" handles—by preshrinking the eye end of the handle so that it can't shrink, together with patented wedges and a double tapered eye socket in the head, Stanley Hammer handles stay tight permanently. Stanley-Atha Hammers are made in various styles and prices to meet the need of every tool user. Compare the design and balance of a Stanley-Atha Hammer with any other in the same price range. You too will agree they are the greatest hammer values ever offered.



Stanley - Atha No. 51½ Size 1½, 16 oz. Super heat - treated head and "Ever-tite" handle make this hammer the carpenter's first choice.

The Steel Square

By L. PERTH

INDEX

1843 STANLEY 1943

INTRODUCTION

AMONG all the tools used by the carpenter there is, perhaps, none so useful, simple and indispensable as the modern Steel Square. There is not a tool that may be so readily applied to the quick solution of the many difficult problems of laying out work as the Steel Square. In the hands of one who knows how to use it the square becomes a simple calculating device of the most wonderful capacity.

There is a feeling among carpenters, that one must have a knowledge of higher mathematics in order to be able to use a Steel Square with all its complicated markings, figures and tables. This is not true. With its numerous scales and figures there is nothing about it that is complicated.

The understanding of a very few simple rules governing the application of this Square will enable the carpenter:

To easily and quickly determine the length of any Common, Hip, Valley or Jack Rafter for any Pitch of Roof. To make the proper Top and Bottom Cuts as well as Side or Cheek Cuts for any Rafter.

The Steel Square herein illustrated is one of the several made by *Stanley Tools, New Britain, Conn.* This Square is known as No. R-100 and may be relied upon as being as near perfect as it is possible to make them.

The great variety of markings on the Blade and Tongue of this Square cover almost everything that this instrument is capable of and make it adaptable for almost any purpose the carpenter may require.

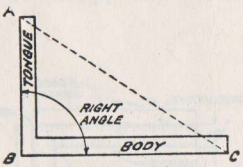
Its superior quality of material, supreme workmanship, accuracy of graduations and completeness of Reference Tables make it the best instrument for framing purposes on the market today.

1. THE SQUARE

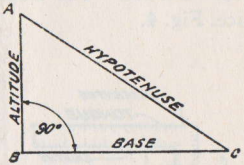
The Steel Square is made in the form of a right angle, that is its two arms (the body and the tongue) make an angle of 90 degrees, which is a right angle.

By referring to the diagram in Fig. 1, it will be noted that if we connect points "A" and "C" by drawing a straight line we will have a triangle "ABC," and since the angle "B" on the Square is a right angle—the triangle will be a "right-triangle." Therefore the Steel Square as well as all roof framing is based on the principles of a right triangle.

A right triangle is a figure having three sides: Base, Altitude and Hypotenuse. The hypotenuse is the longest side of the triangle and is always opposite the right angle. Fig. 2.



STEEL SQUARE.
FIG. 1.



RIGHT TRIANGLE.
FIG. 2.

The reference tables on the *Stanley Squares* were carefully prepared in accordance with the above mentioned principles.

The following terms identifying the different portions of the Steel Square should be noted and remembered:

The Steel Square consists of two parts: the Body or Blade and the Tongue. Figs 3 and 4.

1. BODY. The Body is the longer and wider part. The Body of the Stanley Standard Steel Square is 24 inches long and 2 inches wide.

2. TONGUE. The Tongue is the shorter and narrower part and usually is 16 inches long and 1½ inches wide.

3. HEEL. The point at which the body and tongue meet on the outside edge of the Square is called the Heel. The intersection of the inner edges of the body and tongue is sometimes also called the Heel.

4. FACE. The Face of the Square is the side on which the name "*Stanley*" is stamped, or the visible side, while holding the body in the left hand and tongue in the right hand. Fig. 3.

5. BACK. The Back is the side opposite to the face. Fig. 4.

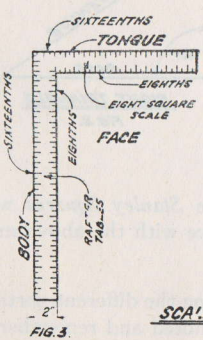


FIG. 3.

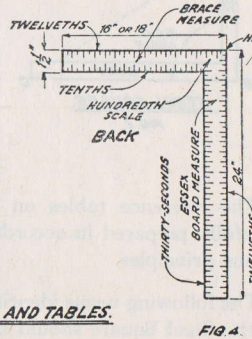


FIG. 4.

SCALES AND TABLES.

The modern Square usually has two kinds of markings: Scales and Tables.

6. SCALES. The Scales are the inch divisions found on the outer and inner edges of the Square and the inch graduations into fractions of an inch. The *Stanley Square* illustrated herein has the following Scales and Graduations:

Face of body	—outside edge	.....Inches and Sixteenths.
" " "	—inside edge	.....Inches and Eighths.
Face of tongue	—outside edge	.....Inches and Sixteenths.
" " "	—inside edge	.....Inches and Eighths.
Back of body	—outside edge	.....Inches and Twelfths.
" " "	—inside edge	.....Inches and Thirty-seconds.
Back of tongue	—outside edge	.....Inches and Twelfths.
" " "	—inside edge	.....Inches and Tenths.

7. HUNDREDTH SCALE. This scale is located on the back of the tongue, in the corner of the Square, near the Brace measure. The Hundredth Scale is "one inch divided into one hundred parts." With the aid of a pair of dividers decimal fractions of an inch can easily be obtained. Fig. 5.

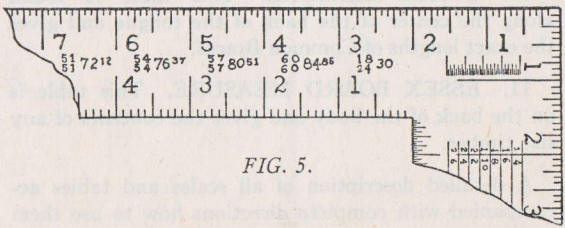


FIG. 5.

8. RAFTER TABLES. These tables will be found on the face of the body and will help you to determine rapidly the lengths of rafters as well as their cuts.

The rafter tables consist of six lines of figures and their use is indicated on the left end of the body:

The first line of figures gives the lengths of Common rafters per foot run.

The second line gives the lengths of Hip and Valley Rafters per foot run.

The third line gives the length of the first Jack Rafter and the differences in the length of the others centered at 16 inches.

The fourth line gives the length of the first Jack Rafter and the differences in length of the others spaced at 24 inch centers.

The fifth line gives the side cuts of Jacks.

The sixth line gives the side cuts of Hip and Valley Rafters.

9. OCTAGON SCALE. The Octagon or "eight square" scale is found along the center of the face of the tongue. By the use of this scale a square timber may be shaped into one having eight sides or an "octagon."

10. BRACE MEASURE. This table is found along the center of the back of the tongue and gives the exact lengths of Common Braces.

11. ESSEX BOARD MEASURE. This table is on the back of the body and gives the contents of any size timber.

A detailed description of all scales and tables accompanied with complete directions how to use them will be found on the following pages.

2. ROOF FRAMING

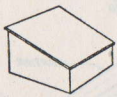
There are numerous types of roofs and a great variety of shapes. The following are the most common in use:

12. SHED OR LEAN-TO ROOF. This is the simplest type of a roof and has only a single slope. Fig. 6.

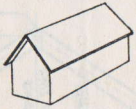
13. GABLE OR PITCH ROOF. This is a type of roof most commonly used. It has two slopes meeting at the center or ridge and forming a Gable. It is a very simple form of a roof and, perhaps, the easiest to construct. Fig. 7.

14. HIP ROOF. This roof consists of four sides, all sloping toward the center of the building. The rafters run up diagonally to meet the ridge, into which the other rafters are framed. Fig. 8.

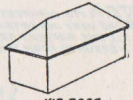
15. GABLE AND VALLEY OR HIP AND VALLEY ROOF. This is a combination of two Gable or Hip roofs intersecting each other. The Valley is the place of meeting of two slopes of the roof, running in different directions. There is a great variety of modifications of this roof and the intersections usually are at right angles. Figs. 9 and 10.



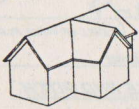
LEAN-TO ROOF.
FIG. 6.



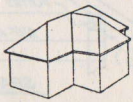
GABLE ROOF.
FIG. 7.



HIP ROOF.
FIG. 8.



GABLE AND VALLEY ROOF.
FIG. 9



HIP AND VALLEY ROOF.
FIG. 10.

The following definitions relating to the various roof members and terms used in roof framing should be carefully noted and committed to memory:

16. SPAN. The Span of a roof is the distance over the wall plates.

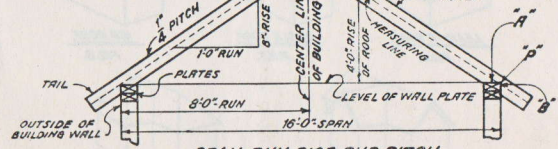
17. RUN. The Run of a roof is the shortest horizontal distance measured from a plumb line through the center of the ridge to the outer edge of the plate. In equally-pitched roofs the Run is always equal to half of the span or generally half the width of the building.

18. RISE. The Rise of a roof is the distance from the top of the ridge and of the rafter to the level of the foot. In figuring rafters the rise is considered as the vertical distance from the top of the wall plate to the upper end of the measuring line.

Rule. To find the rise of a roof multiply the pitch by the span.

Example. A building is 24 feet wide and has a roof ⅓ pitch. What is the rise?
Rise equals ⅓ x 24 = 8 feet.

The span, run, rise, pitch and measuring line are illustrated in Fig. 11.



SPAN, RUN, RISE AND PITCH.
FIG. 11

19. DECK ROOF. When rafters rise to a deck

instead of a ridge the width of the deck should be subtracted from the span and the remainder divided by two will equal the run. Thus in Fig. 12 the span equals 32 feet and the deck is 12 feet wide. The difference between 32 and 12 is 20 feet, divided by 2 equals 10 feet, which is the run of the common rafters. Since the rise equals 10 feet it is a ½ pitch roof.

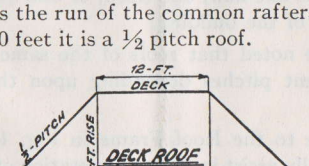


FIG. 12.

20. PITCH. The Pitch of a roof is the slant or the slope from the ridge to the plate and it may be expressed in several ways:

A. The Pitch may be described in terms of the ratio of the total rise of the roof to the total width of the building. Thus the Pitch of a roof having a 24 ft. span with an 8 ft. rise—will be 8 divided by 24 equals ⅓ Pitch. Fig. 13.

B. The Pitch of a roof may also be expressed as so many inches of vertical rise to each foot of horizontal run.

A roof with a 24 ft. span and rising 8 inches to each foot of run will have a total rise of 8 x 12 = 96 inches or 8 ft. 8 divided by 24 equals ⅓. Therefore the roof is ⅓ Pitch. Fig. 13.

Rule. To find the pitch of a roof divide the rise by the span.

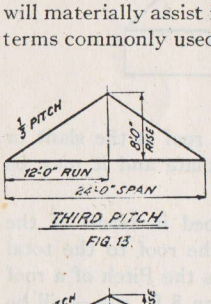
Example. A building is 24 ft. wide and has a roof with a 6 ft. rise. What is the pitch of the roof? Fig. 14.

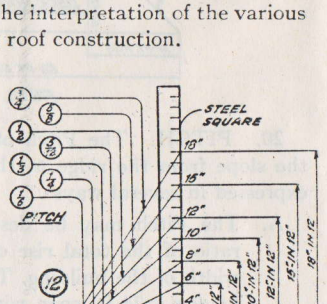
Pitch equals 6 divided by 24 equals ¼.

21. PRINCIPAL PITCHES. The diagram in Fig. 15 shows the principal Roof Pitches. They are called ½ pitch, ⅓ pitch, as the case may be, because the height from the level of the wall plate to the ridge of the roof is one half, one third, or one quarter of the total width of the building.

It will be noted that roofs of the same width may have different pitches depending upon the height of the roof.

Reference to the Roof Frame in Fig. 16 (page 17) will materially assist in the interpretation of the various terms commonly used in roof construction.





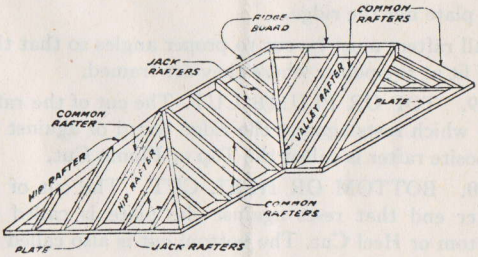
22. The principal members of the roof frame are the Plates at the bottom and the Ridge Board at the top. To them the various rafters are being fastened.

23. PLATE. The plate is the roof member to which rafters are framed at their lower ends.

The top "A" and the outside edge of the plate "B" are the important surfaces from which rafters are measured. Fig. 11.

24. RIDGE BOARD. The Ridge Board is the horizontal member used for connecting the upper ends of rafters on one side to the rafters on the opposite side.

In cheap construction the ridge board is usually omitted and the upper ends of the rafters are spiked together.



ROOF FRAME

FIG. 16

25. COMMON RAFTERS. A Common Rafter is a roof member extending at right angles from the plate to the ridge.

26. HIP RAFTERS. A Hip Rafter is a member extending diagonally from the corner of the plate to the ridge.

27. VALLEY RAFTERS. A Valley Rafter is one extending diagonally from plate to ridge at the point of intersection of two roof surfaces.

28. JACK RAFTERS. Any rafter that does not extend from plate to ridge is called a Jack Rafter.

There are different kinds of Jacks and according to the position they occupy they may be classified as:

A. Hip Jacks,
B. Valley Jacks, and
C. Cripple Jacks.

A Jack Rafter with the upper end resting against a hipand lower end against the plate is called a Hip Jack.

A Jack with the upper end resting against the ridge board and lower end against the valley is called a Valley Jack.

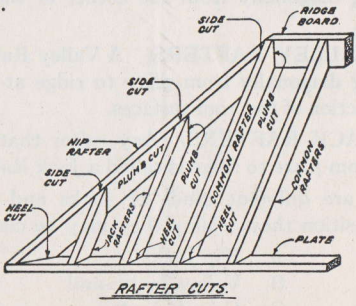
A Jack that is cut in between a hip and valley rafter is called a Cripple Jack. A Cripple Jack touches neither the plate nor the ridge.

All rafters must be cut to proper angles so that they will fit at the points where they are framed.

29. TOP OR PLUMB CUT. The cut of the rafter end which rests against the ridge board or against the opposite rafter is called the Top or Plumb Cut.

30. BOTTOM OR HEEL CUT. The cut of the rafter end that rests against the plate is called the Bottom or Heel Cut. The bottom cut is also called the Foot or Seat Cut.

31. SIDE CUTS. Hip and Valley Rafters as well as all Jacks besides having top and bottom cuts must also have their sides at the end cut to a proper bevel so that they will fit into the other members to which they are to be framed. These are called Side Cuts or Cheek Cuts. All rafters and their cuts are indicated in Fig. 17.



RAFTER CUTS.

FIG 17

32. MEASURING LINE. This is a temporary line on which the length of the rafter is measured. This line runs parallel to the edge of the rafter and passes through the point "P" on the outer edge of the plate which is the point from which all dimensions are determined. Fig. 11, Page 14.

33. LENGTH. The length of a rafter is the shortest distance between the outer edge of the plate and the center of the ridge line.

34. TAIL. That portion of the rafter extending beyond the outside edge of the plate is called the Tail or Eave. The Tail is figured separately and is not included in the "length" of the rafter. Fig. 11, Page 14

35. LENGTH PER FOOT RUN. The rafter tables on the *Stanley Squares* are based on the "rise per foot run" which means that the figures in the tables indicate the length of rafters "per one foot run" of common rafters for any rise of roof. This principle is clearly illustrated in Fig. 18

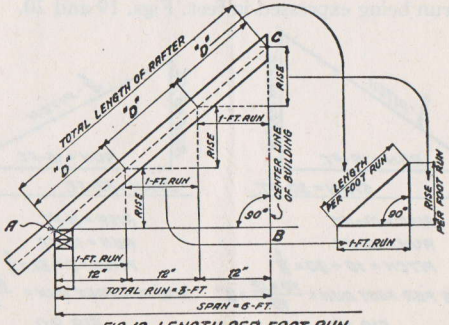


FIG. 18. LENGTH PER FOOT RUN.

The roof has a 6 foot span and a certain rise per foot. The figure may be regarded as a right triangle "ABC" having for its sides the run, rise and the rafter.

The run of the rafter has been divided into three equal parts each representing "one foot run."

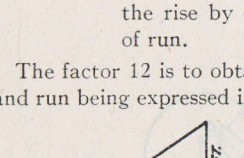
It will be noted that by drawing vertical lines through each division point of the run the rafter also will be divided into three equal parts "D.".

Since each part "D" represents "the length of rafter per one foot run" and the total run of the rafter equals three feet, it is evident that the "total length" of rafter will equal the "length D" multiplied by 3.

The reason for using this "per foot run" method is that the length of any rafter may be easily determined for any width of building. The length per foot run will be different for different pitches, therefore before you can establish the length of a rafter you must know the rise of roof in inches or the "rise per foot run."

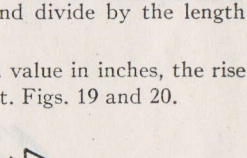
Rule. To find the rise per foot run, multiply the rise by 12 and divide by the length of run.

The factor 12 is to obtain a value in inches, the rise and run being expressed in feet. Figs. 19 and 20.



RISE = 10-FT.
RUN = 15-FT.
PITCH = 10 ÷ 30 = 1/3
RISE PER FOOT RUN = $\frac{10 \times 12}{15} = 8''$

FIG. 19.



RISE = 8-FT.
RUN = 16-FT.
PITCH = 8 ÷ 32 = 1/4
RISE PER FOOT RUN = $\frac{8 \times 12}{16} = 6''$

FIG. 20.

The rise per foot run is always the same for a given pitch and can be easily remembered for all ordinary pitches, thus:

PITCH	1/2	1/3	1/4	1/6
RISE PER FOOT RUN IN INCHES	12	8	6	4

36. The members of a firmly constructed roof should fit snugly against each other. Rafters that are not properly cut make a shaky roof and impair the stability of the structure. Therefore it is very essential that all rafters should be of correct lengths and their ends properly cut so as to provide a full bearing against the members to which they are connected.

Correct length, proper top and bottom cuts and the right side or cheek cuts are the very important features to be observed when framing a roof.

The length of rafters may be obtained in several ways such as:

1. Mathematical calculations,
2. Measuring across the square,
3. Stepping off with the square.

The first method while being absolutely correct is very impractical for use on the job; the other two are rather unreliable and quite frequently result in costly mistakes.

The complete Rafter Tables on the "Stanley" *Steel Squares* have eliminated the necessity of using the above methods. These Tables enable the carpenter to rapidly find the exact length and cuts for any rafter thus saving his time and avoiding the possibility of errors.

3. COMMON RAFTERS

37. DEFINITION OF LENGTH. A Common

Rafter extends from the plate to the ridge. Therefore it is evident that the rise, run and the rafter itself form a "right triangle."

The length of a Common Rafter is the shortest distance between the outer edge of the plate and a point on the center line of the ridge. This length is taken along the "measuring line" which runs parallel to the edge of the rafter and is the "hypotenuse" or the longest side of a right triangle, the other two sides being the run and the rise. Fig. 21.

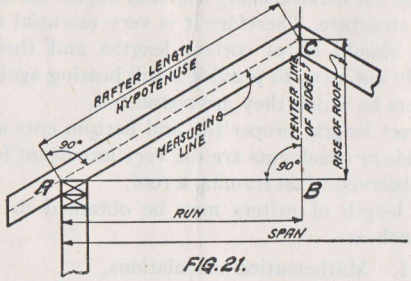


FIG. 21.

The Rafter Tables on the face of the body include the outside edge graduations on both body and tongue which are in inches and sixteenths of an inch.

38. LENGTH OF RAFTERS. The lengths of Common Rafters are found on the "first" line indicated as: Length of main rafters per foot run. There are seventeen of these tables beginning at 2 inches and continuing to 18 inches. Fig. 22.

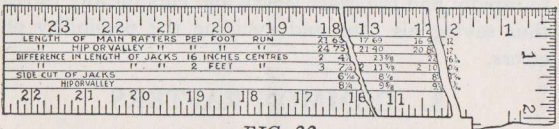


FIG. 22

Rule. To find the length of a common rafter—multiply the "length given in the table" by the number of feet of the run.

Example. Find the length of a common rafter where the rise of roof is 8 inches per foot run or one third pitch and building is 20 feet wide. First find on the "inch line" on the top edge of the body the figure that is equal to the rise of the roof which in this case will be 8. On the first line under the figure 8 will be found 14.42 which is the length of the rafter in inches "per foot run" for this particular pitch. Fig. 23.

The building is 20 feet wide. Therefore the run of the rafter will be 20 ÷ 2 equals 10 feet.

Since the length of the rafter per "one foot run" equals 14.42 inches, the total length of rafter will be 14.42 multiplied by 10 which equals 144.20 inches or 144.20 ÷ 12 equals 12.01 feet or for practical purposes 12 feet. Fig. 24.

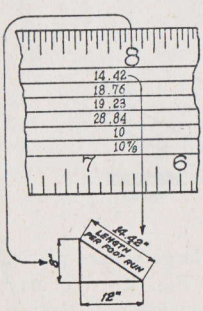


FIG. 23.

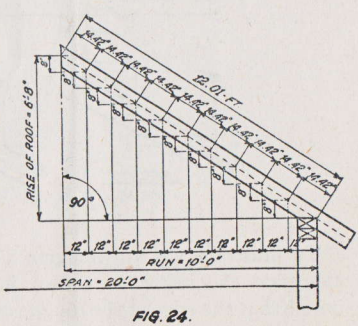


FIG. 24.

39. TOP AND BOTTOM CUTS. The top or plumb cut is the cut at the upper end of the rafter where it rests against the opposite rafter or against the ridge board.

The bottom or heel cut is the cut at the lower end which rests on the plate.

The top cut is parallel to the center line of the roof, the bottom cut is parallel to the horizontal plane of the plates. Therefore the top and bottom cuts are at right angles to each other.

Rule. To obtain the top and bottom cuts of a common rafter use 12 inches on the body and the "rise per foot run" on the tongue. 12 inches on the body will give the horizontal cut and the figure on the tongue the vertical cut.

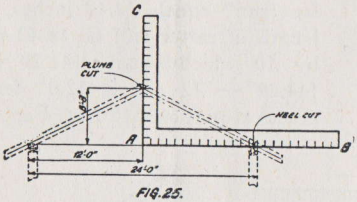
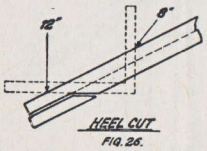
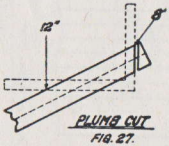


FIG. 25.



HEEL CUT
FIG. 26.



PLUMB CUT
FIG. 27.

To illustrate we will imagine a large square placed alongside the rafter as shown in Fig. 25. We may notice that the edge of the tongue coincides with the top

cut of the rafter and the edge of the blade coincides with the heel cut. If this square were marked in feet it would show the run of the rafter on the body and the total rise on the tongue. The line "AB" would give us the bottom cut and line "AC" the top cut.

However, the regular square is marked in inches and since the relation of the rise to one foot run is the same as the total rise bears to the total run, we use 12 inches on the blade, and the "rise per foot" on the tongue to obtain the respective cuts. The distance "12" is used as a unit and is the "one foot run" while the figure on the other arm of the square represents the "rise" per foot run. Figs. 26 and 27.

40. ACTUAL LENGTH. The lengths of rafters obtained from the tables are "to the center line of the ridge." Therefore the thickness of half of the ridge board should always be deducted from the obtained total length before the top cut is made. Fig. 28. This deduction of half the thickness of the ridge is measured at right angles to the Plumb line and is marked parallel to this line.

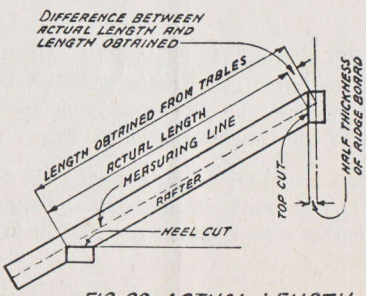
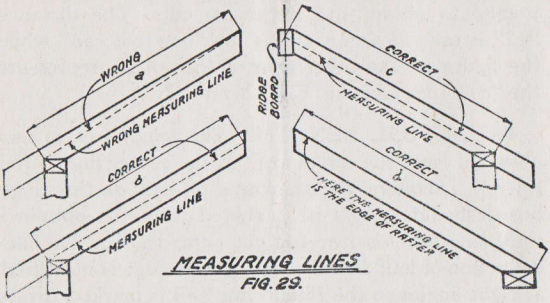


FIG. 28.-ACTUAL LENGTH.

41. The diagrams below illustrate the wrong and right way of measuring the length of rafters. Fig. 29. The diagram "D" shows the measuring line as the edge of the rafter which is the case when there is no tail or eave.



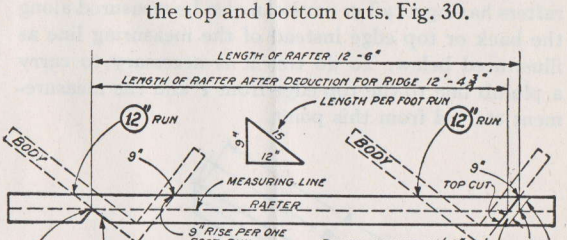
MEASURING LINES
FIG. 29.

42. APPLYING THE SQUARE. After the total length of the rafter has been established both ends should be marked and allowance made for a tail or eave, and for half the thickness of the ridge.

Both cuts are obtained by applying the Square so that the 12 inch mark on the body and the mark on the tongue that represents the rise shall be at the edge of the stock.

All cuts for common rafters are made at right angles to the side of the rafter.

Example. A common rafter is 12 ft. 6 inches, the rise per foot run being 9 inches. Obtain the top and bottom cuts. Fig. 30.



APPLYING THE SQUARE.

FIG. 30

Points "A" and "B" are the ends of the rafter. To obtain the bottom or seat cut take 12 inches on the body of the square and 9 inches on the tongue. Lay the square on the rafter so that the body will coincide with point "A" or the lower end of the rafter. Mark along the body of the square and cut.

To obtain the top cut move the square so that the tongue coincides with point "B" which is the upper end of the rafter. Mark along the tongue of the square.

43. DEDUCTION FOR RIDGE. The deduction for half the thickness of the ridge should now be measured. Half the thickness of the ridge is 1 inch. One inch is deducted at right angles to the top cut mark or plumb line, point "C." A line is then drawn parallel to the top cut mark and the cut made. You will notice that the allowance for half the ridge measured along the measuring line is 1¼ inches. This will vary according to the rise per foot run. It is therefore important to measure for this deduction at right angles to the top cut mark or plumb line.

44. MEASURING RAFTERS. The length of rafters having a tail or eave can also be measured along the back or top edge instead of the measuring line as illustrated below. To do this it is necessary to carry a plumb line to the top edge from P and the measurement started from this point.

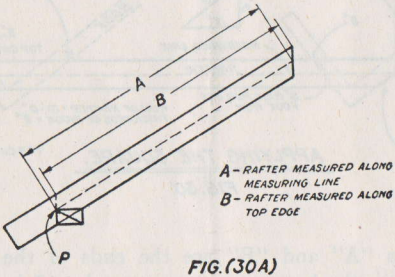


FIG. (30A)

45. ODD INCHES OF COMMON RAFTERS. Occasionally in framing a roof the run may have an odd number of inches as in the case of a building with a span of 24 feet 10 inches. This would mean a run of 12 feet 5 inches. The additional five inches can be easily added without mathematical division after the figures obtained from the square for 12 feet of run are measured. The additional five inches are measured at right angles to the last plumb line as illustrated in Fig. (30B).

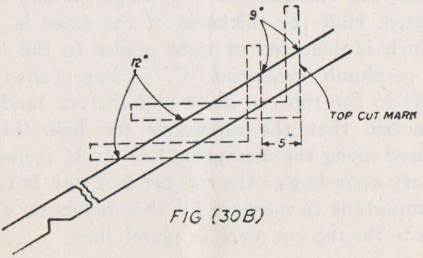
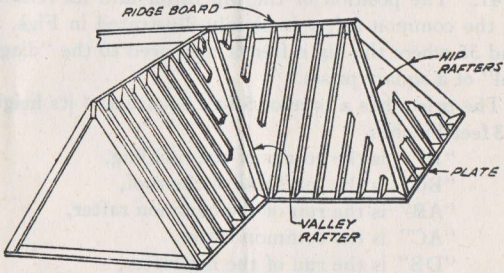


FIG (30B)

4. HIP AND VALLEY RAFTERS

46. The Hip Rafter is a roof member that forms a "hip" in the roof usually extending from the corner of the building diagonally to the ridge.

The Valley Rafter is similar to the hip only that it forms a "valley" or depression in the roof instead of a hip. It also extends diagonally from plate to ridge. Therefore the total rise of hip and valley rafters is the same as that of common rafters. Fig. 31.



HIP AND VALLEY RAFTERS.
FIG. 31.

The relation of hip and valley rafters to common rafters is the same as the relation of the sides of a right triangle; therefore it will be well to explain here one of the main features of right triangles:

In a right triangle if the sides forming the "right angle" are 12 inches each the hypotenuse or the side

opposite the right angle is equal to 16.97 inches which is usually taken as "17" inches. Fig. 32.

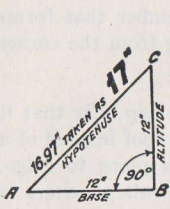
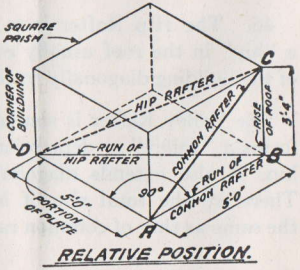


FIG. 32.



RELATIVE POSITION.

FIG. 33.

47. The position of the hip rafter and its relation to the common rafter is plainly illustrated in Figs. 33 and 35 where the hip rafter is compared to the "diagonal" of a square prism.

The prism has a base of 5 feet square and its height is 3 feet 4 inches.

"D" is the corner of the building,
"BC" is the total rise of the roof,
"AB" is the run of the common rafter,
"AC" is the common rafter,
"DB" is the run of the hip rafter,
"DC" is the hip rafter.

It will be noted that the figure "DAB" is a right triangle whose sides are: the portion of the plate—"DA," the run of common rafter—"AB" and the run of hip rafter—"DB." The run of the hip rafter being opposite the right angle "A" is the "hypotenuse" or the longest side of the right triangle.

If we should take only one foot of run of common rafter and one foot length of plate we will have a right triangle "H" whose sides are each 12 inches long and whose hypotenuse is 17 inches or more accurately 16.97 inches. Fig. 35.

The hypotenuse in this small triangle "H" is a portion of the run of the hip rafter "DB" which corresponds to one foot run of common rafter.

Therefore the "run of hip rafter" is always 16.97 inches for every 12 inches of foot run of common rafter, and the "total run" of hip rafter will be 16.97 inches multiplied by the number of feet run of common rafter.

48. LENGTH OF HIP AND VALLEY RAFTERS. The lengths of hip and valley rafters are found on the "second" line of the rafter table entitled: "Length of hip or valley rafters per foot run," which means that the figures in the table indicate the length of hip and valley rafters "per foot run of common rafters." Fig. 22.

Rule. To find the length of a hip or valley rafter—multiply the length given in the table by the number of feet of the run of common rafter.

Example. Find the length of a hip rafter where the rise of roof is 8 inches per foot run or one third pitch and building is 10 feet wide. Fig. 35.

Proceed the same as in the case of common rafters, i. e., find on the "inch line" of the body of the square the figure corresponding to the rise of roof—which is 8. On the "second" line under this figure is found "18.76" which is the length of hip rafter in inches for each

foot of run of common rafter for one third pitch. Fig. 34.

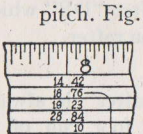


FIG. 34.

FIG. 35.

The common rafter has a 5 foot run and therefore there are also 5 equal lengths for the hip rafter as may be seen in the illustration. Fig. 35.

We have found the length of the hip rafter to be 18.76 inches per one foot run. Therefore the total length of hip rafter will be 18.76 x 5 = 93.80 inches = 7.81 feet or for practical purposes 7 feet 9⅝ inches.

49. TOP AND BOTTOM CUTS. The following rule should be followed for top and bottom cuts.

Rule. To obtain the top and bottom cuts of hip or valley rafters use 17 inches on the body and the "rise per foot run" on the tongue. 17 on the body will give the seat cut and the figure on the tongue the vertical or top cut. Fig. 36.

50. MEASURING HIP AND VALLEY RAFTERS. The length of all hip and valley rafters must always be measured along the center of the top edge or back. The rafters with a tail or eave are treated similar to common rafters as mentioned in paragraph No. 44 and illustrated in Fig. (30A), page 28, except the measurement or measuring line is the center of the top edge.

51. DEDUCTION FROM HIP OR VALLEY RAFTER FOR RIDGE. The deduction for the ridge is measured the same as for the common rafter, Fig. 30, page 27, except that half the diagonal (45°) thickness of the ridge must be used.

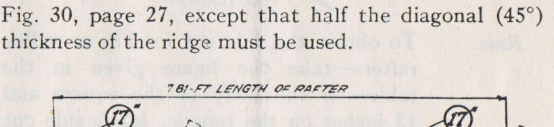


FIG. 36.

52. SIDE CUTS. Hip and valley rafters in addition to the top and bottom cuts must also have side or check cuts at the point where they meet the ridge.

These side cuts are found on the "sixth" or bottom line of the Rafter tables which is marked: "Side cut hip or valley—use."

The figures given in this line refer to the graduation marks on the "outside edge of the body." Fig. 22.

The figures on the square have been derived by determining the figure to be used with 12 on the tongue for the side cuts of the various pitches by the following method:

From a plumb line the thickness of the rafter is

measured and marked at right angles as at A, Fig. (36A). A line is then squared across the top of the rafter and the diagonal points connected as at B. The line B or side cut is obtained by marking along the tongue of the square.

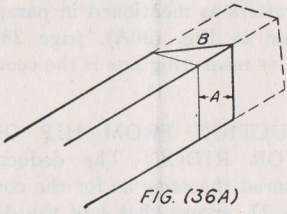
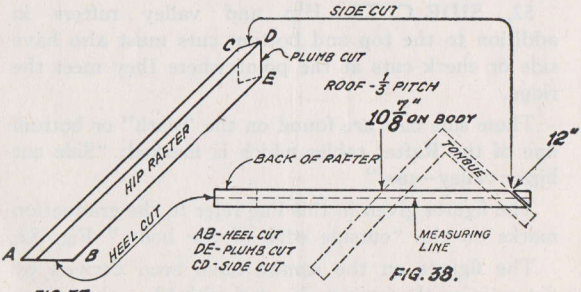


FIG. (36A)

Rule. To obtain the side cut for hip or valley rafters—take the figure given in the table—on the body of the square and 12 inches on the tongue. Mark side cut along the tongue where the tongue coincides with the point on the measuring line.

Example. Find side cut for hip rafter—the roof having 8 inches rise per foot run or one third pitch. Figs. 37 and 38.



HIP RAFTER CUTS.

Figure 37 represents the position of the hip rafter on the roof. The rise of roof

being 8 inches to the foot, first locate the figure 8 on the outside edge of the body. Under this figure in the bottom line you find "10⅞." This figure is taken on the body and 12 inches on the tongue. The square is applied to the edge of the back of the hip rafter. The side cut "CD" comes along the tongue.

The deduction for half the thickness of the ridge must be determined and measured the same as for the common rafters, Fig. 30, page 27, except that half the diagonal (45°) thickness of the ridge must be used.

In making the seat cut for the hip rafter an allowance must be made for the top edges of the rafter which would project above the line of the common and jack rafters if the corners of the hip rafter were not removed or "backed." The hip rafter must be slightly lowered by cutting parallel to the seat cut a distance which varies with the thickness and pitch of the roof.

53. It should be noted that on the Stanley Squares the 12 inch mark on the tongue is always used in all angle cuts, both top, bottom and side, thus leaving the workman but one number to remember when laying out side or angle cuts, namely the figure taken from the fifth or sixth line in the table.

The side cuts come always on the "right hand" or "tongue" side on rafters. When marking boards these can be reserved for convenience at any time by taking the 12 inch mark on the body and using the body references on the tongue.

54. ODD INCHES OF HIP AND VALLEY RAFTERS. For obtaining additional inches in run of hip or valley rafters similar to the explanation for common rafters, No. 45, page 28—Fig. (30B), the diagonal (45°) of the additional inches or approximately 7 1/16 inches for five inches of run should be used in a similar manner.

5. JACK RAFTERS

55. Jack rafters are "discontinued" common rafters—or common rafters "cut off" by the intersection of a hip or valley before reaching the full length from plate to ridge.

Jack rafters lie in the same plane with common rafters. They usually are spaced the same and have the same pitch and therefore they also have the same length per foot run as common rafters have.

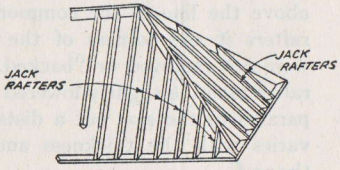


FIG. 39.

Jack rafters are usually spaced 16 inches or 24 inches apart and as they rest against the hip or valley equally spaced the second jack must be twice as long as the first one, the third three times as long as the first and so on. Fig. 39.

56. LENGTH OF JACK RAFTERS. The lengths of jacks are given in the third and fourth line of the rafter tables and are indicated:

3rd line: "Difference in length of Jacks—16 inches centers."

4th line: "Difference in length of Jacks—2 feet centers."

The figures in the table indicate the "length of the first or shortest Jack" which is also the difference in length between the first and second between the second and third jack and so on.

Rule. To find the length of a jack rafter, multiply the value given in the tables by the number indicating the position of the jack. From the obtained length subtract half the diagonal (45°) thickness of the hip or valley rafter.

Example. Find the length of the second jack rafter, the roof having a rise of 8 inches to 1 foot of run of common rafter, the spacing of jacks being 16 inches.

On the outer edge of the body find figure 8 which corresponds to the rise of roof. On the third line under this figure find "19.23." This means that the first jack rafter will be 19.23 inches long. Since the length of the second jack is required, multiply 19.23 by 2 which equals 38.46 inches which for practical purposes is 3 ft. 2½ inches. From this length half the diagonal (45°) thickness of the hip or valley rafter should be deducted in the same manner as the deduction was made on the hip rafter for the ridge.

Proceed in the same manner when the lengths of jacks spaced 24 inch centers are required. It should be borne in mind that the second jack is twice as long as the first one, the third jack is three times as long as the first jack and so on.

57. TOP AND BOTTOM CUTS. Since jack rafters have the same "rise per foot run" as common

rafters, the method of obtaining the top and bottom cuts is the same as for common rafters; i. e., take 12 inches on the body and the rise per foot run on the tongue. 12 inches will give the seat cut and the figure on the tongue—the plumb cut.

58. SIDE CUT. At the end where the jack rafter frames to the hip or valley rafter a side cut is required. The side cuts for jacks are found on the "fifth line" of the Rafter tables and which is marked: "Side cut of jacks—use." Fig. 22.

Rule. To obtain the side cut for a jack rafter —take the figure shown in the table—on the body of the square and 12 inches on the tongue. Mark along the tongue for side cut.

Example. Find side cut for jack rafters—of a roof having 8 inch rise per foot run or ⅓ pitch. Figs. 40 and 41.

Under the figure 8 in the fifth line of the table find "10." This figure taken on the outside edge of the body—and 12 inches on the tongue will give the required side cut.

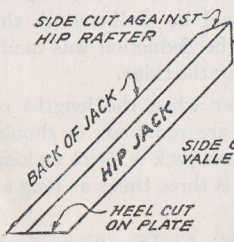


FIG. 40.

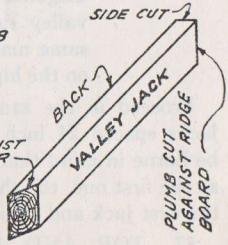


FIG. 41.

6. BRACE MEASURE

59. This table will be found along the center of the back of the tongue and gives the lengths of common braces. Fig. 42.

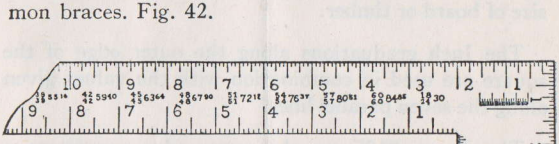


FIG. 42.

Example. Find the length of a brace whose run on post and beam equals 39 inches. Fig. 43. In the Brace table find the following expression:

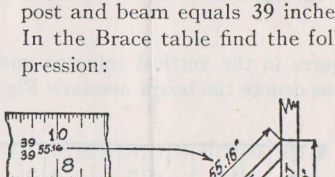


FIG. 43.

39 55.16
39

Which means that with a 39 inch run on the beam and a 39 inch run on the post the length of the brace will be 55.16 inches.

Braces may be regarded as common rafters. Therefore when the brace run on the post differs from the run on the beam—their lengths as well as top and bottom cuts may be determined from the figures given in the tables of common rafters.

7. ESSEX BOARD MEASURE

60. This table appears on the back of the body, and gives the contents in Board Measure of almost any size of board or timber.

The Inch graduations along the outer edge of the square are used in combination with the values given along the seven parallel lines.

The figure "12" on the outer edge represents a "one-inch board—12 inches wide," and is the starting point for all calculations. All the inch graduations on both sides of "12" represent the width and the smaller figures in the column under 12 indicate the length of the piece.

The figures in the vertical columns under the inch graduations denote the board measure. Fig. 44.

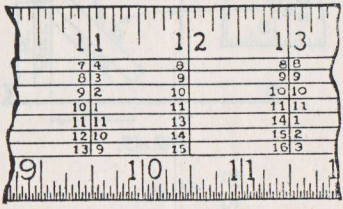


FIG. 44

Rule. To find the contents of a piece of lumber. Under the mark 12 on the outer edge of the square find the "length" of the piece. Along the same scale of inch graduations locate the "width" of the timber. Then follow the line on which the length is stamped toward the column of figures

under the given width. The figure given at the point of intersection indicates the board measure of the piece.

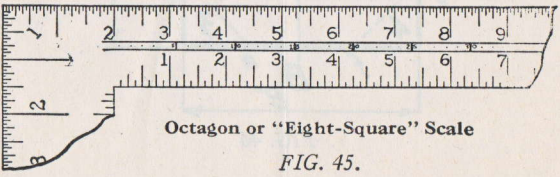
Example. Find the board measure of a board 8 feet long and 11 inches wide.

First find 8 feet in the column under "12" for the length in feet, then find 11 inches on the top edge of the square for the width in inches: follow the lines to where they come together and 7-4 or seven and four twelfths is found to be the number of feet in the board.

The figures in the tables are given for boards "one inch" thick. To obtain the contents for any other thickness multiply the figure given in the table by the thickness of the timber.

8. EIGHT SQUARE SCALE

61. This scale is along the center of the face of the tongue and is used for laying off lines to cut an "eight-square" or octagon piece of timber from a square one. Fig. 45.



Octagon or "Eight-Square" Scale

FIG. 45.

Example. Required to shape an octagon out of a square timber "ABCD" 8 inches square. Through the center of the timber draw lines "AB" and "CD" parallel to the sides and at right angles to each other. With dividers take as many spaces from the scale as there are inches in the width of the stick—8 and lay off this space on both sides of points A, B, C and D, as Aa, Ab, Bf, Be, Ch, Cg, Dc, and Dd. Draw lines ah, bc, de and fg and cut off solid triangles 1, 2, 3 and 4. This will make an octagon or an "eight square." Fig. 46.

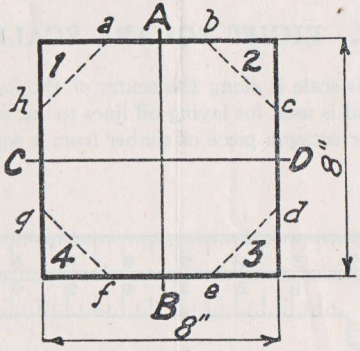


FIG. 46

LENGTH OF SIDES WITH A CIRCUMSCRIBED DIAMETER OF 1 FT.

3	Sides...	10.3923 in.
4	" ...	8.4953 "
5	" ...	7.0534 "
6	" ...	6.0000 "
7	" ...	5.2070 "
8	" ...	4.5921 "
9	" ...	4.1042 "
10	" ...	3.7032 "
11	" ...	3.3813 "
12	" ...	3.1058 "
14	" ...	2.6688 "
16	" ...	2.3410 "
18	" ...	2.0888 "
20	" ...	1.8771 "

LENGTH OF SIDES WITH AN INSCRIBED DIAMETER OF 1 FT.

3	Sides...	20.7840 in.
4	" ...	12.0000 "
5	" ...	8.7184 "
6	" ...	6.9282 "
7	" ...	5.7795 "
8	" ...	4.9705 "
9	" ...	4.3576 "
10	" ...	3.8990 "
11	" ...	3.5230 "
12	" ...	3.2154 "
14	" ...	2.7373 "
16	" ...	2.3869 "
18	" ...	2.1159 "
20	" ...	1.9005 "

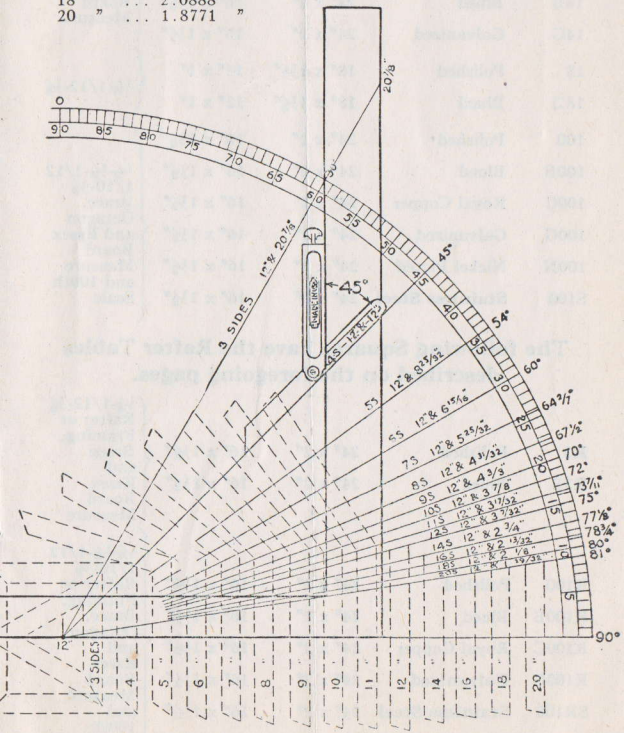


FIG. 47. POLYGONS AND THEIR MITERS

No.	*Finish*	*Body*	*Tongue*	*Graduated*
3	Polished	24″ x 2″	16″ x 1½″	1/16-1/12-¼ Brace and Essex Board Measure
3B	Blued	24″ x 2″	16″ x 1½″	
3G	Galvanized	24″ x 2″	16″ x 1½″	
10	Polished	12″ x 1½″	8″ x 1″	1/12-⅛-¼
12	Polished	12″ x 1½″	8″ x 1″	1/16-1/12-⅛
14	Polished	24″ x 2″	16″ x 1½″	⅛-¼ Essex Board Measure
14B	Blued	24″ x 2″	16″ x 1½″	
14G	Galvanized	24″ x 2″	16″ x 1½″	
18	Polished	18″ x 1½″	12″ x 1″	1/16-1/12-⅛
18B	Blued	18″ x 1½″	12″ x 1″	
100	Polished	24″ x 2″	16″ x 1½″	1/32-1/16-1/12 1/10-⅛ Brace, Octagon and Essex Board Measure and 100th Scale
100B	Blued	24″ x 2″	16″ x 1½″	
100C	Royal Copper	24″ x 2″	16″ x 1½″	
100G	Galvanized	24″ x 2″	16″ x 1½″	
100N	Nickel Plated	24″ x 2″	16″ x 1½″	
S100	**Stainless Steel**	24″ x 2″	16″ x 1½″	

The following Squares have the Rafter Tables described on the foregoing pages.

R3	Polished	24″ x 2″	16″ x 1½″	1/16-1/12-¼ Rafter or Framing, Brace and Essex Board Measure
R3B	Blued	24″ x 2″	16″ x 1½″	
R100	Polished	24″ x 2″	16″ x 1½″	1/32-1/16-1/12 1/10-⅛ Rafter or Framing, Brace, Octagon and Essex Board Measure and 100th Scale
R100B	Blued	24″ x 2″	16″ x 1½″	
R100C	Royal Copper	24″ x 2″	16″ x 1½″	
R100G	**Galvanized**	24″ x 2″	16″ x 1½″	
SR100	**Stainless Steel**	24″ x 2″	16″ x 1½″	

LAYING OUT A STAIR

Books have been written about the great many applications of the Square for framing trusses, towers, circles, polygon shaped structures, etc., which we cannot include in these few pages.

Public libraries are apt to have several volumes for the person who wants to study the wide range of uses of the Steel Square. Stair building alone has many ramifications.

In the following we offer just the fundamentals for laying out a straight stair.

First. Determine the height or Rise from the top of the floor from which the stairs start, to the top of the floor on which they are to end.

Second. Determine the Run or distance measured horizontally.

Third. Mark the total Rise on a rod or a piece of furring 1″ x 2″ to make a so called "story pole." Divide the height or Rise into the number of risers desired. A simple method is to lay out the number of risers wanted by spacing off the total Rise with a pair of compasses. It is common to have this result in fractions of an inch.

Example: Total Rise 8′—3¾″ or 99¾″ divided by fourteen = 7.125″ or 7⅛″ riser.

The above procedure is not necessary in the next step because the horizontal distance, or Run, is seldom limited to an exact space as is the case of the Rise.

Fourth. Lay out or space off the number of treads wanted in the horizontal distance or Run. There is always one less tread than there are risers. If there are 14 risers in the stair there are only 13 treads.

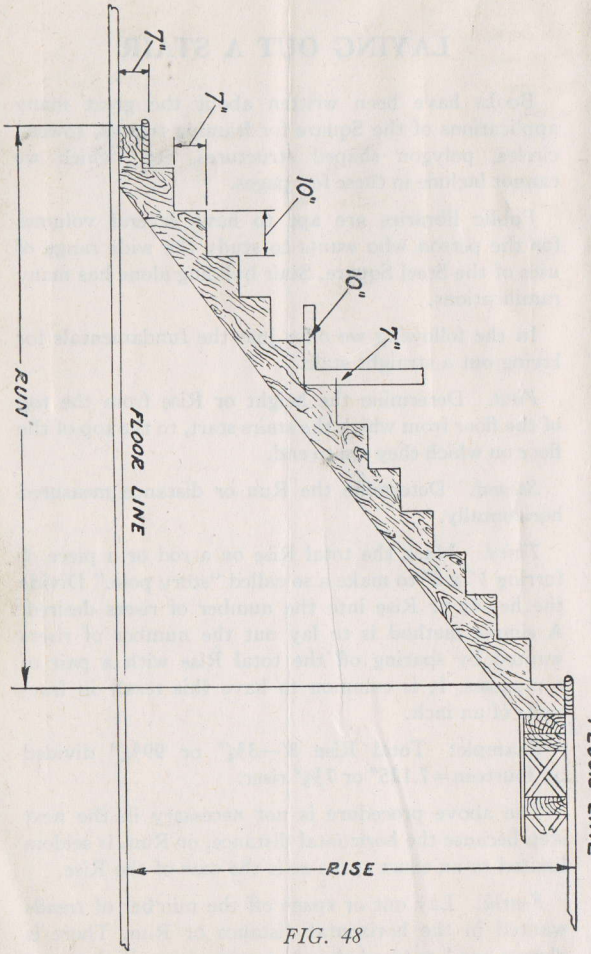


FIG. 48

NOTE: The stairs shown with approximately the above dimensions of the riser and tread are considered easy or comfortable to climb.

Example: If the tread is 10″ wide and the riser is 7″, the stair stringer would be layed out or so called "stepped off" with the square, ready for cutting as shown in Fig. 48.

The thickness of the tread should be deducted from the first riser as shown, in order to have this first step of uniform height with all the others.

A reference book for all tool users—

The Stanley No. 34 Tool Catalog is more than a mere tool catalog. It illustrates and describes more tools than any other catalog. Included in this book you will also find important tables and data that will help you with many questions dealing with measurements and construction.

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